

In-Touch

Opus Research

Issue 9, July 2015



CITIES GLOBALLY ARE TAKING A MORE SUSTAINABLE AND RESILIENT PATH FORWARD

Rotterdam: Erasmus Bridge.

OPUS RESEARCH LEADER PETER BENFELL HAS RECENTLY RETURNED FROM A NZ GOVERNMENT-EUROPEAN UNION STUDY TRIP ON THE 'RESILIENCE OF URBAN INFRASTRUCTURE'.

This was a fantastic opportunity to engage with researchers and practitioners in Austria, Germany and The Netherlands.

The World Business Council for Sustainable Development's Vision 2050 (www.wbcsd.org/vision2050.aspx) was led by major multinationals and has a vision of 'Nine billion people living well within the limits of the planet'.

Global population is forecast to grow 30% to 9 billion by 2050 and 70% of all people globally will live in urban areas so cities and infrastructure are highly prominent in the 'pathway to 2050'.

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REALISING VALUE FROM OUR DIGITAL ASSETS

HOW VALUABLE IS AERIAL PHOTOGRAPHY TO THE NEW ZEALAND ECONOMY? WHAT ARE THE TANGIBLE BENEFITS OF IMPROVING THE ACCURACY OF DIGITAL PROPERTY BOUNDARIES? WILL A NATIONAL ROAD NETWORK DATASET CREATE EFFICIENCIES AND SAVE MONEY?

These are all important questions that Opus Research has been helping our clients understand over the past three years. Resolving these issues is a vital step towards improving our understanding of digital information's value, and securing further investment into these fundamental but often overlooked New Zealand assets.

Opus was part of a project led by Land Information New Zealand (LINZ) which concluded that improved coordination of

digital imagery procurement would add an estimated \$4.2M to the New Zealand economy by 2021. In addition, innovations facilitated by better aerial imagery access could add over \$85M to the New Zealand economy by 2021.

Digital property boundaries are integral to management of New Zealand's land and property ownership systems, but at present not all boundaries held digitally by LINZ are survey accurate. An Opus-led study in 2013 found that improved adoption of spatial information technologies, enabled by an improved digital cadastre, could underpin an increased value to the New Zealand economy of \$59M in 2017.

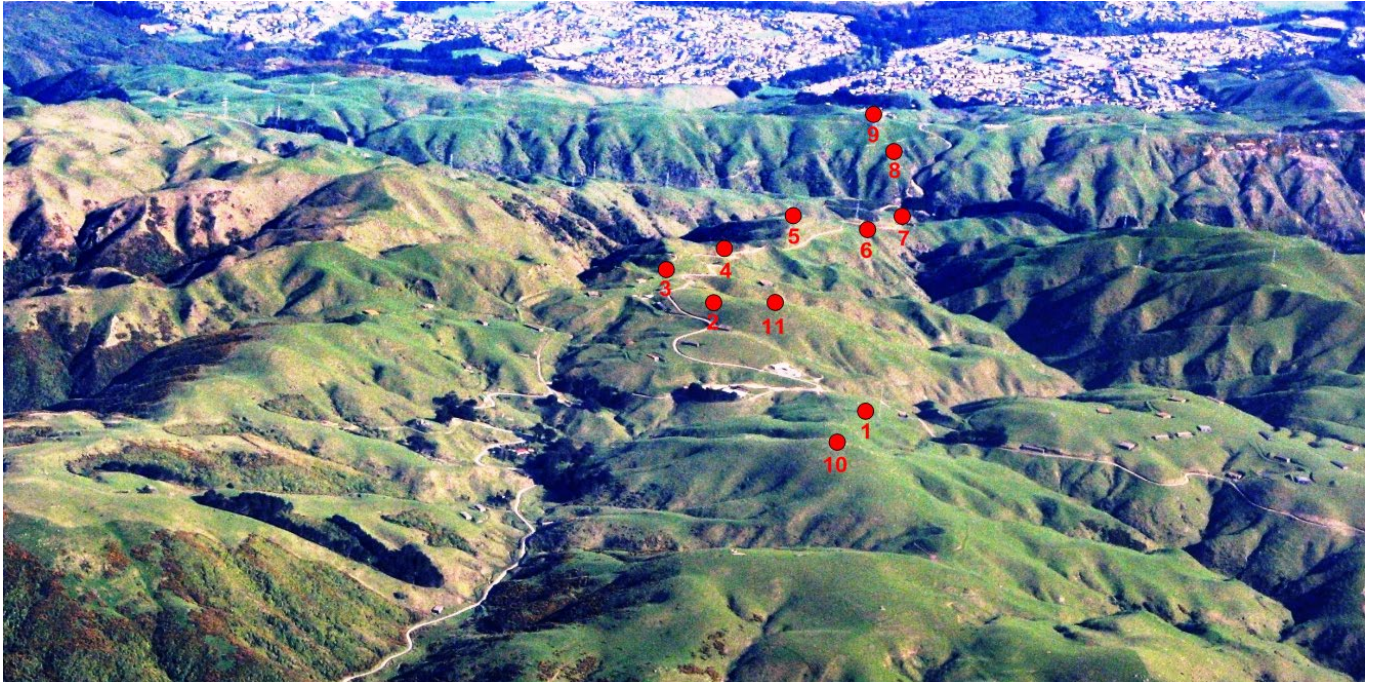
During 2014, Opus assisted the NZ Transport Agency to better understand the benefits of investing in a national road network dataset. Currently, over ten different road datasets are used by the Agency alone for road safety analysis, asset management and other purposes. This has resulted in considerable additional expense relating to dataset maintenance and acquisition,

as well as potential inefficiencies when communicating information referenced back to the various datasets.

'Making digital part of our DNA' is a key future need identified by the Auditor General last year, based on reviews of public sector organisations and their digital information usage. Accurate and relevant data underpins good use of digital services, and supports accountable and transparent decision-making. The obvious growth in magnitude and applicability of digital information over time amplifies the importance of making correct investment decisions towards improving these assets.

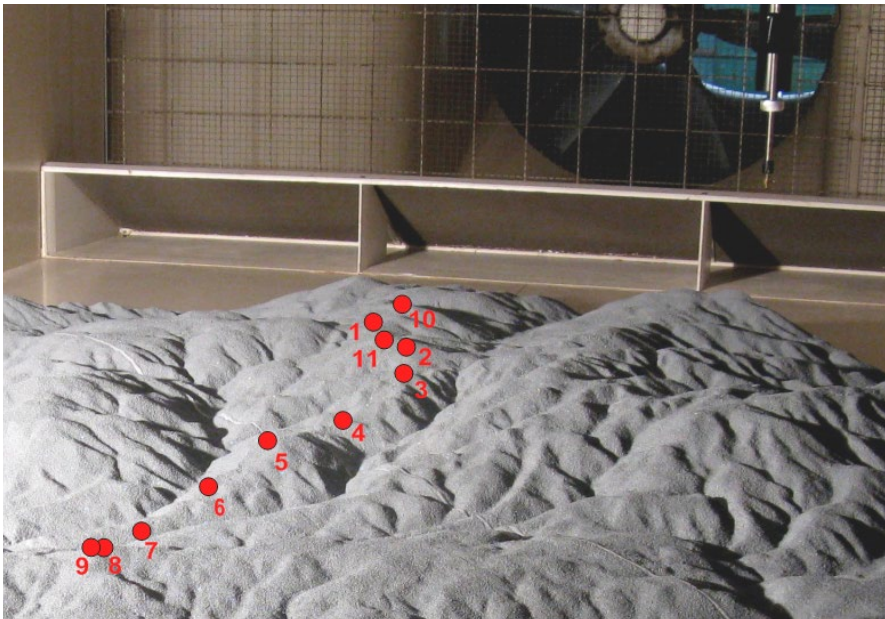
Opus has a long and respected track record in managing physical infrastructure assets, and there are obvious parallels and opportunities for applying best practice research and asset management methodologies directly to the management of our clients' growing digital information as well.

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Data points on terrain near Wellington.

WIND SPEED HILL SHAPE MULTIPLIERS



Terrain model undergoing wind tunnel investigation.

THE OBJECTIVE OF THIS RESEARCH HAS BEEN TO PROVIDE IMPROVED METHODS FOR STRUCTURAL DESIGNERS TO CALCULATE APPROPRIATE LEVELS OF DESIGN WIND SPEEDS FOR HILLY BUILDING SITES.

Opus Research has been collaborating on a 'wind speed hill shape multipliers' research study that includes researchers from NIWA, GNS Science and University of Auckland. The study has been funded by the Natural Hazards Research Platform.

Procedures to calculate design wind speeds are provided in international wind loading standards, such as the Australian/New Zealand Standard AS/NZS 1170.2. The current method allows designers to calculate design wind speeds for a simple isolated hill with a reasonable degree of accuracy.

However, hills in New Zealand are seldom simple in shape – typically the terrain is highly complex. When a designer attempts to apply the current speed calculation method to these realistic hill shape combinations, significant inaccuracies in calculated wind speeds frequently occur. In particular, literal application of the procedure in AS/NZS 1170.2 is likely to substantially underestimate true wind speed at a complex hill-shape site. In these instances, the hill shape multiplier has the potential to cause a three-fold increase in wind loads on buildings and structures – a potential for error in the analysis that is very concerning.

Belmont Regional Park, north of Wellington City, was selected to investigate wind speeds over hills for this study. The research included on-site wind speed measurements for eleven locations on 9m high anemometer masts, as well as wind tunnel testing, and computational fluid dynamics (CFD) analysis.

Our best estimates of the true wind speeds on the study site were obtained using a combination of these three methods. We are preparing recommendations for improved methods for the calculation of wind speed hill shape multipliers for use in design standards.

Paul Carpenter

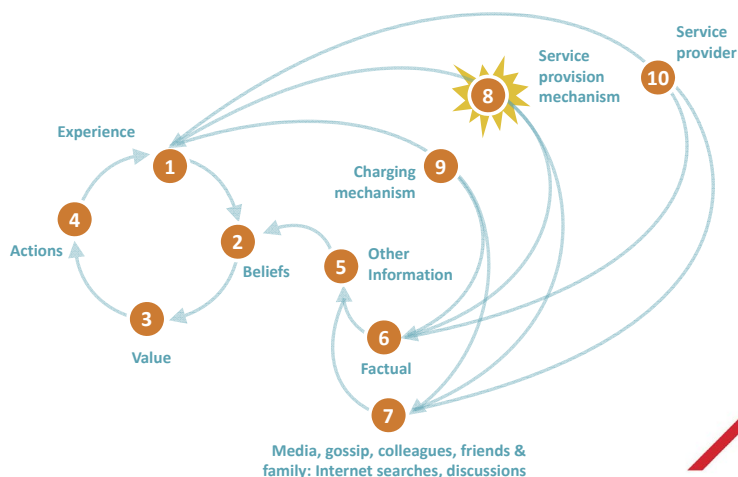
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INVESTIGATING FUTURE ATTITUDES TO INFRASTRUCTURE DECISIONS



ANNA ROBAK IS AN OPUS TECHNICAL PRINCIPAL BASED IN AUCKLAND, WITH QUALIFICATIONS IN ENGINEERING AND ECONOMICS. ANNA SPECIALISES IN COMMUNICATING THE IMPACTS OF INFRASTRUCTURE INVESTMENTS.

Updated model for exploring alternate realities



The thrust of the presentation was twofold: first, a robust infrastructure strategy is critical because the world is changing so quickly relative to the life of our infrastructure; and second, in order to plan for alternate realities, we need to understand how people are likely to react to the situations and solutions we propose.

Anna's research looked at the willingness of infrastructure services customers to invest in infrastructure based on different scenarios, and the personal investments they make to improve infrastructure service quality. Anna found that people will always want some degree of control over the infrastructure they use and how they use it. She also found that people tend to value services more highly when they have greater awareness of the service, and when they have greater trust in their service provider.

Organisations can make strategies more effective by using rational procedures based on robust information; minimising 'politics'; and by using highly effective communication with staff and stakeholders.

To effectively plan for future infrastructure needs, organisations need to understand how users value infrastructure, and how we can make sure that what is provided is actually important for users. Low costs and an environmental focus are also important. To develop a robust strategy, implementation matters at least as much as planning. In short, share a compelling vision, be transparent, and build trust as implementation progresses.

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Citizens make infrastructure decisions all the time – how they will get to work, how much they are willing to pay to take a bus, whether they are willing to support a toll road... This is economics; weighing up alternatives and making choices.

Anna helps asset owners to understand the relative value people place on infrastructure service alternatives. She also helps asset owners to provide citizens with information to encourage support for initiatives with better social, economic

and environmental outcomes.

Anna is passionate about the use of non-asset solutions (e.g. the use of behavioural and natural solutions) to reduce the cost of services while producing better outcomes overall.

Anna recently attended the Canadian Network of Asset Managers conference in Vancouver, Canada to deliver a keynote presentation on planning for alternate infrastructure realities.

REDUCING DAIRY EFFLUENT POND EMISSIONS



Dairy effluent ponds integrate with the farm environment over time.



**A MULTIDISCIPLINARY
OPUS TEAM DELIVERED
A PROJECT FOR THE
NZ AGRICULTURAL
GREENHOUSE GAS
RESEARCH CENTRE ON
REDUCING EFFLUENT
POND EMISSIONS.**

The project investigated the use of methanotroph bacteria to convert methane produced from dairy farm effluent ponds to CO₂. External science experts from Landcare, NIWA and the NZ Agricultural Greenhouse Gas Research Centre were also involved as collaborative partners to ensure that the project outcome benefited from the full breadth of expertise available.

Two methods of using the methanotroph bacteria to reduce dairy pond emissions were considered:

- Seeding methanotrophic organisms into floating media on top of the ponds.
- Covering ponds to capture the gases produced, and then feeding the gases through a biofilter that has been seeded with methanotrophs.

NIWA had also previously investigated the potential for farms to cover ponds with a synthetic cover, and then to pipe captured biogas to a flare to be combusted.

The collaborative project team was engaged to undertake an assessment of the engineering feasibility of the methane-scrubbing systems proposed by

Landcare, and to compare costs, viability and efficiency of the two methanotroph methods with the cover/capture/flare alternatives.

Opus facilitated a workshop with NZAGRC, Landcare and NIWA to better understand the issues involved for each option. The team then developed conceptual designs based on workshop outcomes, and provided an in-depth analysis and comparison of options that considered methane reduction rates, indicative construction and operation costs, and risks.

The team also developed a fourth alternative solution for an 'open biofilter' design, which had the potential to be more cost-effective than the other methanotroph options.

On completion of the project, the client's Operations Manager, Heather Went, said they were "very happy with the standard of the final report", and that it provided the necessary information they needed to inform their decision-making processes.

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OPUS DEVELOPS INNOVATIVE MANHOLE COVER



An installed RotaRing® cover

MOST DRIVERS HAVE EXPERIENCED THE FRUSTRATION OF TRAVELLING OVER AN INCORRECTLY POSITIONED MANHOLE COVER OR ONE THAT HAS SLUMPED. THE RESULT IS NOT ONLY A SIGNIFICANT ‘BUMP’ FOR DRIVERS, BUT ALSO ONGOING AND INCREASINGLY COSTLY DAMAGE TO THE ROAD ASSET.

RETROFIT TO EXISTING MANHOLE



Cut out pavement in a diamond shape



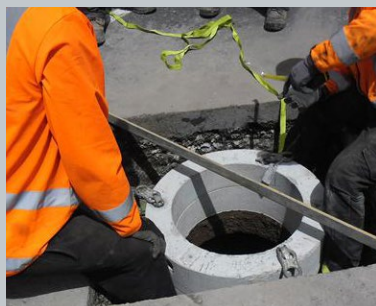
Excavate to chamber lid and check depth



Place RotaRing® set, rotate to correct position and install set screws



Place frame and check cross fall levels



Remove top ring, place sealant, replace top ring and denso tape set screws



Replace cover and frame, pour mixed concrete to cover to finished level

Senior Roading Engineer Neil Gumbley, based with Opus in Rotorua, has wide experience in the New Zealand road transport sector. Neil has put this experience to use in an exciting and innovative way, by developing a novel – and simple – solution that takes the frustration out of misaligned manhole covers for road-users and maintenance operators alike.

Neil has been working alongside a team that includes in-house support from Opus and external practical expertise from Hynds. The result: the RotaRing® Adjustable Levelling Rings Series, which has recently been patented and released to the market. The RotaRing® system is based on a patented set of easily adjustable, tapered and interlocking rings, which allows road technicians to adjust the final height and orientation of an existing or new manhole cover. The outcome is reduced risk of road and pavement damage for asset owners and a better, safer experience for road users.

Various RotaRing® component height options are available, providing a solution for most new and retrofitting situations. The system allows infinite adjustment to ensure a perfect final alignment with the road camber on a site-by-site basis. Applications include stormwater and sewerage manholes in municipal, residential and commercial locations. The system meets the requirements of ISO 9001 Quality Management Standard, as well as New Zealand Standards NZS3101 and NZS3109.

Neil Gumbley

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WELLINGTON HIGHWAYS TESTING

IN LATE 2014, A COMBINED OPUS-FULTON HOGAN TEAM (CALLED CAPITAL JOURNEYS) WON THE WELLINGTON STATE HIGHWAY MANAGEMENT CONTRACT FOR A PERIOD OF SEVEN YEARS.

As part of this contract, Opus Research is providing site investigation and laboratory testing services to the contract. The work includes investigation of existing pavements, testing to support pavement design and QA testing of new pavements.

It is still very early in the contract delivery phase, but already our research teams have provided ITS (Indirect Tensile Strength) testing of foamed bitumen and cement stabilised basecourse, plateau density and NDM compaction analysis, and a range of laboratory soil and aggregate tests. On-site work is primarily undertaken at night to reduce disruption to traffic flows. The investigation and analysis work has been carried out by Gary Bentley, David Pollard, Murray McLachlan, Bill Graham and Julian Gillespie, integral members of the Opus Research Testing Services Group.

Sheldon Bruce

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NEW TO THE TEAM



JULIAN GILLESPIE

Julian Gillespie is the latest addition to the Opus Research Testing Services team. Julian has a degree in science, majoring in earth science, from the University of Auckland. He will be undertaking a combination of

laboratory and field project work.

Julian is a native Wellingtonian and has recently returned home to settle in Karori. His out-of-work interests include playing football and rock climbing.

Julian Gillespie

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JOVANA BALANOVIC

Jovana Balanovic (Yovi for short) has recently joined the Behavioural Sciences team. She recently graduated from Victoria University in Wellington with an MSc in cross-cultural psychology, which involved examining

the way that psychological processes are shaped by cultural-level factors. Jovana's research interest arose from her own personal experience of migrating from Serbia to New Zealand with her family when she was a young girl.

In addition to her research interests, Jovana is also a cycling, yoga and meditation enthusiast.

Jovana Balanovic

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NATIONAL SCIENCE CHALLENGE ON RESILIENCE

OPUS IS A MEMBER OF A NEW NATIONAL SCIENCE CHALLENGE (NSC) ON RESILIENCE TO NATURE'S CHALLENGES. THERE ARE 11 NATIONAL SCIENCE CHALLENGES THE GOVERNMENT IS FUNDING TO SUPPORT MAJOR COLLABORATIVE RESEARCH EFFORTS TO CONTRIBUTE TO ADDRESSING NEW ZEALAND'S MAJOR AND COMPLEX ISSUES.

National Science Challenges are designed to take a more strategic approach to the Government's science investment by targeting a series of goals, which, if they are achieved, would have major and enduring benefits for New Zealand.

This NSC has a goal of Transformative Resilience for New Zealand, to make NZ a safer place to live and a more attractive, lower risk investment opportunity. The other members of this NSC are: GNS Science, NIWA, Scion, BRANZ and the following universities – Auckland, Canterbury, Lincoln, Massey, Otago and Victoria.

Opus researchers and consultants will be contributing throughout the Challenge through their involvement in a number of research programmes. This includes work that will be developing ways to help communities and organisations change how they make decisions leading to resilience, shifting attitudes and behaviours about disaster risk management to a more resilient culture, and understanding how we can enhance the resilience of key infrastructure such as transport networks. The research programmes will be taking place in a range of rural and urban settings, and will include communities, private and public sector organisations, and central government.

An important part of the Resilience Challenge will be mapping and monitoring resilience progress. Chris Bowie and Vivienne Ivory of Opus Research have been contributing to a research project revealing how disaster-related resilience is currently measured or benchmarked in New Zealand and other countries. It has highlighted the need for a range of measurement tools and datasets that are relevant to New Zealand, and that can work across different types of hazards.

Vivienne Ivory

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On the study tour we saw excellent examples of cities gearing themselves to a more resilient and sustainable future – and the significant role research is playing.

The cover image is Rotterdam's Erasmus Bridge, in a city which has co-existed very successfully with water for centuries and aims to continue this whilst adapting to water level changes resulting from climate change. Rotterdam's a remarkable city and it was inspiring to engage with its proud civic leaders who are vigorously charting its future success. This highlighted the importance of governance and leadership to infrastructure resilience.

The iconic bridge's 82 metre long bascule section raises for shipping traffic using one of the world's largest and most sophisticated ports. The port is undergoing massive expansion, with a 700 hectare section of reclaimed land recently opened – including the world's first fully automated container terminal.

In-Touch has a diverse range of recent Opus Research projects making a contribution to improving the resilience of infrastructure. Please don't hesitate to contact me or one of the staff listed with feedback or any queries.

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